GRUPPO TIM

A transforming scenario & Telco Open Communities experience

ONS Europe - Amsterdam, 25-27 September 2018

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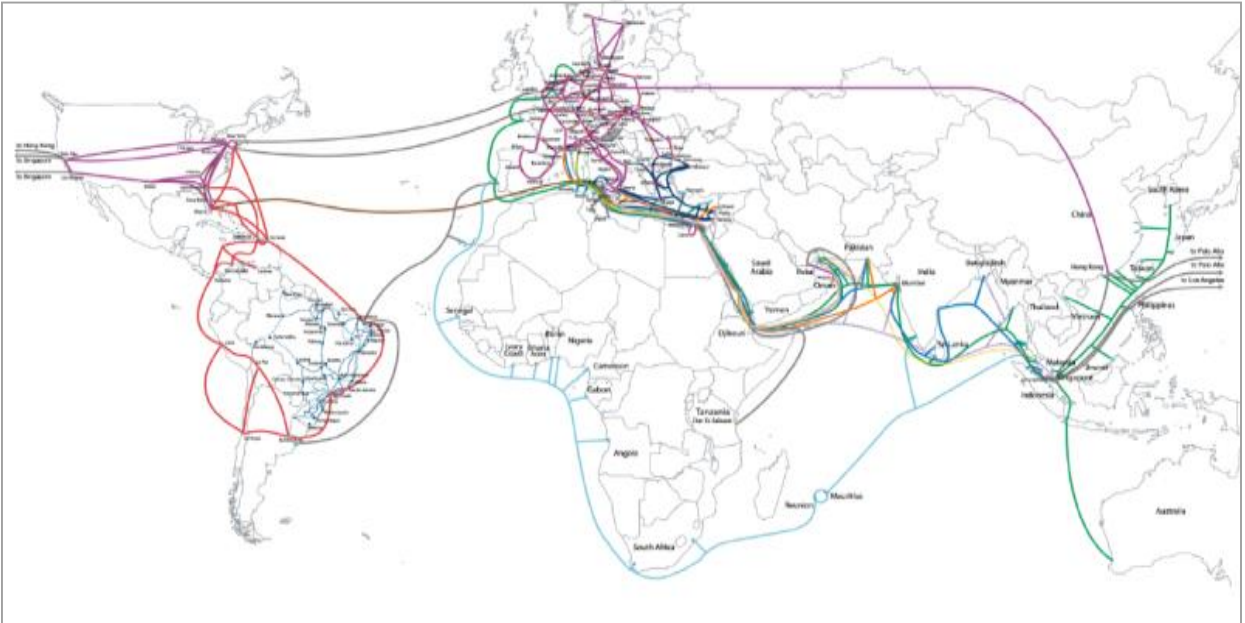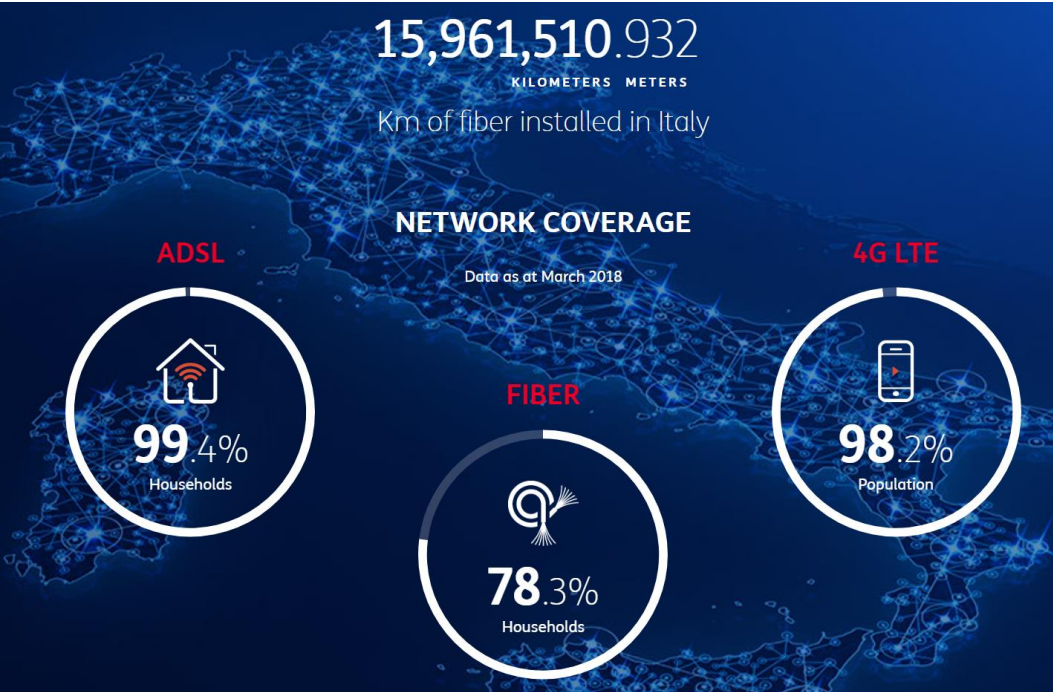Technology Innovation Management - Standard Coordination & IPR

TIM

TIM Key Figures

TIM
Il futuro firmato Telecom Italia

Employees	Customers	Revenue 2017	Investments
60.000	**100**	**19 MDI€**	**3.9 B€**
50.000 in Italy	Millions	14.7 MDI€ in Italy	in Italy 2017

INWIT
Tower company

SPARKLE
Backbone and
International Services

olivetti
ICT and IOT Services

15,961,510.932
KILOMETERS METERS

Km of fiber installed in Italy

NETWORK COVERAGE

Data as at March 2018

ADSL

99.4%
Households

FIBER

78.3%
Households

4G LTE

98.2%
Population

History of Innovation in Telecom Italia Group

1964
CSELT, the R&D Center of Telecom Italia, is born in Torino

1971
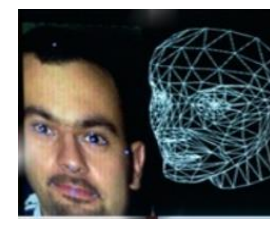The first Italian electronic switching center was built

1976
World first communication on fiber optic for Telephone signal, in Turin

1982
World first fiber optic cable for experimenting with the TV signal is layered in Turin

1988
MPEG and MP3 standards for compressing the audio video signal

1999
First UMTS phone call in the urban environment

2001
CSELT becomes TILab

2009
Turin starts the first experimentation in LTE technology

2016
"Technology Innovation" Department is born
First European Open IoT Lab

2017
Announcement: Turin chosen as 5G City

2018
CTO is created

Main Topics

Activities

- **Architectures and engineering of fixed network, mobile network, core**

- **Proof of Concepts, Prototyping, Trials; focus on 5G and network transformation**

- **Verification of equipment, terminals and services in a controlled environment**

- **Collaboration with Universities and Tech Companies**

- **Focus on Key Standardization bodies for 5G and Leading Industry Fora**

- **IPR Portfolio management > 3000 patents**

Projects, Labs, POC

- **5G Radio and Core Network**

- **Ultrabroadband Fixed**

- **Softwarization and «Network as a Service»**

- **Multiaccess Edge Computing**

- **Internet of Things (NB-IOT Lab)**

- **Service Platform evolution**

- **Artificial Intelligence and Machine Learning**

Outline

ONS Europe - Amsterdam, 25-27 September 2018

- ➤ A transforming Scenario

- ➤ Our Experience in Telco Open Communities

- ➤ Take aways

Telco are facing with...

Data Traffic Exponential increase, especially due to video and new technologies (VR, AR)
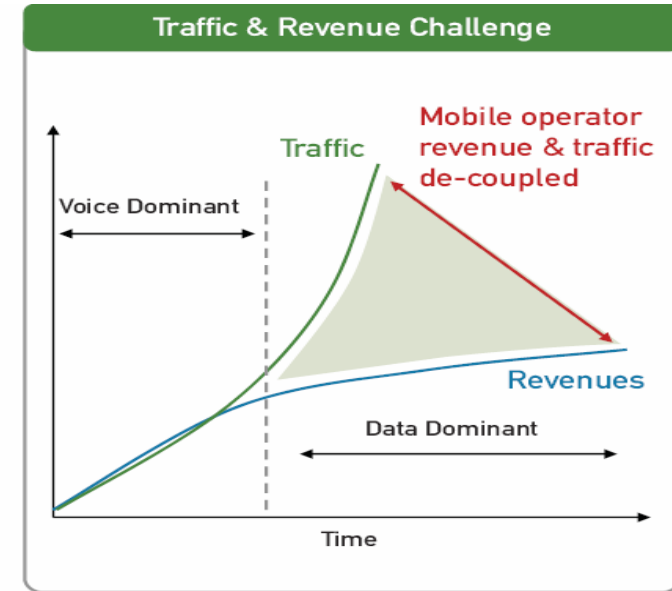
Margin Pressure

Need to **reduce operating costs**

- Simplification of management
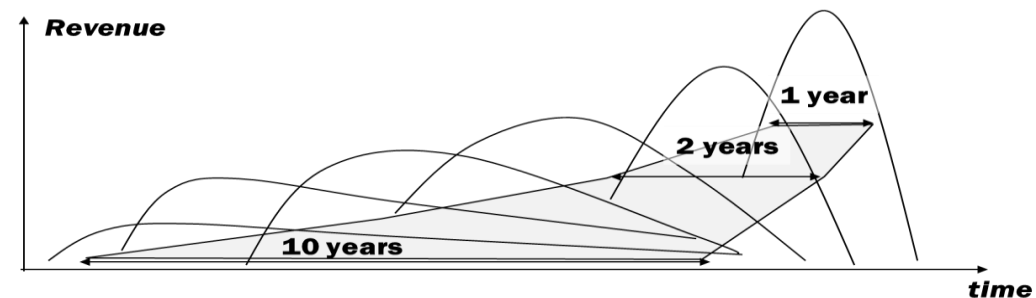- Uniformity / standardization

Need to **cut the cost of capital**

- Reduced investment by bit

Traffic & Revenue Challenge
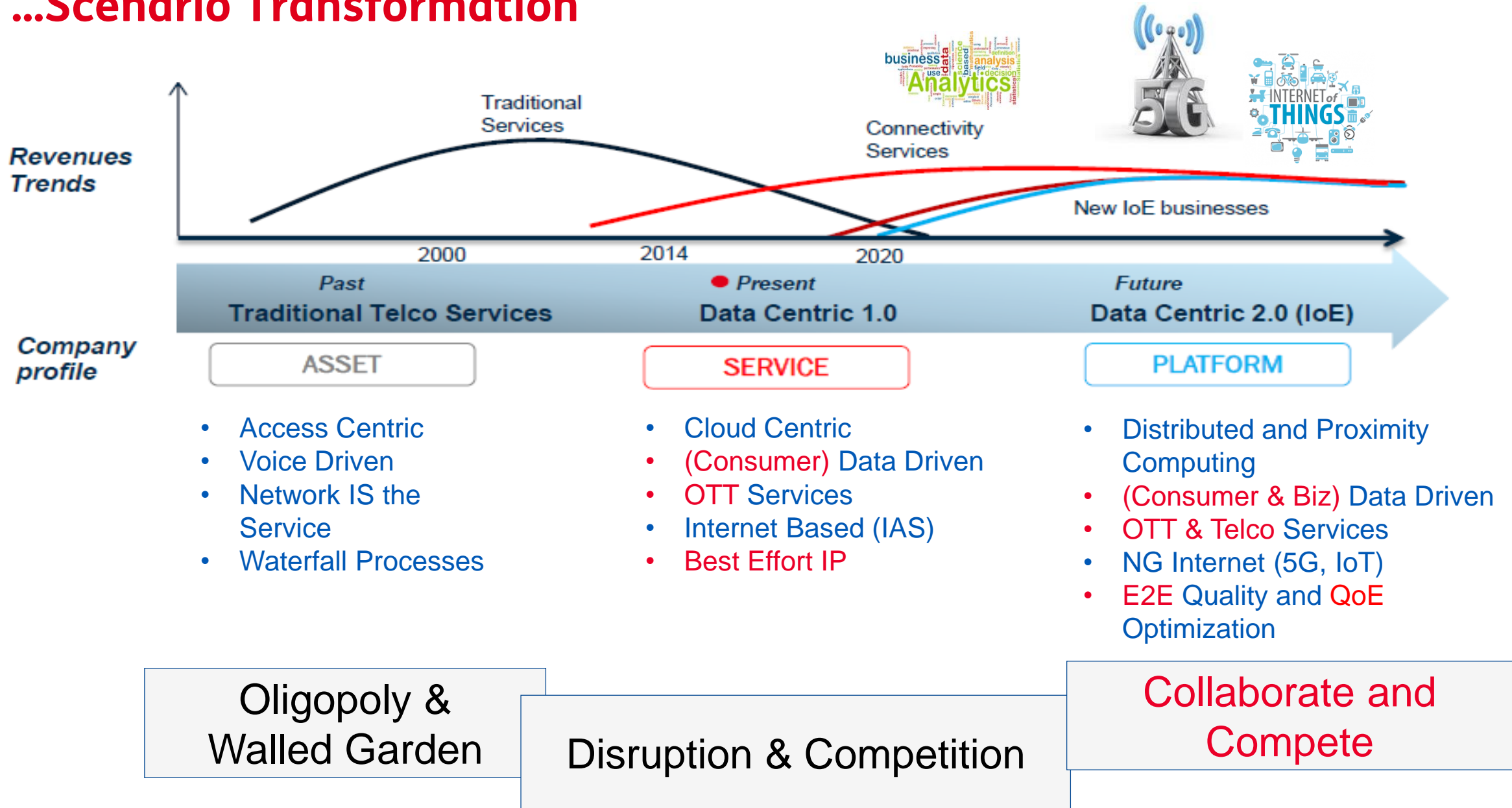
Mobile operator revenue & traffic de-coupled

Voice Dominant

Traffic

Revenues

Data Dominant

Time

Need to **reduce service deployment time and services time to market**
Improve customer experience

Revenue

1 year

2 years

10 years

time

...Scenario Transformation

Revenues Trends

	2000	2014	2020	

Traditional Services — Connectivity Services — New IoE businesses

Past	*Present*	*Future*
Traditional Telco Services	**Data Centric 1.0**	**Data Centric 2.0 (IoE)**

Company profile

ASSET	SERVICE	PLATFORM
• Access Centric • Voice Driven • Network IS the Service • Waterfall Processes	• Cloud Centric • (Consumer) Data Driven • OTT Services • Internet Based (IAS) • Best Effort IP	• Distributed and Proximity Computing • (Consumer & Biz) Data Driven • OTT & Telco Services • NG Internet (5G, IoT) • E2E Quality and QoE Optimization

Oligopoly & Walled Garden

Disruption & Competition

Collaborate and Compete

5G as an Unifying platform

Video=80% IP traffic in 2021
Consumer Cloud Storage 3x from now to 2020

Personal

In 2020, 12B Industry Related connected devices

INDUSTRIAL Internet of things

⚙ Connection
⚙ Things
⚙ Data

Communicate ⚙
Process ⚙
Control ⚙

3D Printing, Connected Factory, Remote Robotics

Digital Universe in 2020=10x than in 2013
Data growth 40% YoY

Cloud Analytics

Machine Learning

Artificial Intelligence

Evolved vRAN

New CORE architecture

New Radio

Active Antennas e Massive MIMO

Slicing

5G ecosystem as driver of a techno-socio-economic transformation

5G is about much more than just faster speeds

Technology innovative features

A *key enabler* of unprecedented features such as network slicing to offer *differentiated services*

NFV and SDN enablers

Full APIzation with Open API-based approach

Componentization / Micro-Services approach to increase modularity

E2E service management & orchestration to manage the whole chain

Agile/DevOps approach to enable automation, flexibility and rapidity

Edge Evolution (1/3)

Multi-access Edge Computing (MEC) is a network-service architectural paradigm extending the Cloud Computing towards the "edge" (i.e., distribution, access segments) of the Telcos Infrastructures.

MEC adoption is mainly motivated by:

- **costs savings in the Cloudification** (i.e., SDN-NFV) of infrastructures: e.g., MEC for deploying smaller Central Offices at the "edge "
- **new revenues generations**: e.g., improving performance of current services and enabling new innovative ones

Among the possible business models, the split of MEC IaaS vs PaaS, with standard interfacing, is key to develop and boost new ecosystems

Telcos – ICT Players partnerships: e.g. outsourcing Cloud-Edge Computing and revenues sharing

MEC Platforms as a Service
(spanning across multi-Operators' domains)

Standard IaaS – PaaS interfacing

MEC Infrastructure as a Service
(multi-Operators interworking)

Telcos partnerships to enable cross-domains ecosystems (great economies of scale, larger abilities to monetize)

MEC is providing Application Developers and Service Providers with a pervasive and flexible network/service environment for developing new ecosystems.

Edge Evolution (2/3)
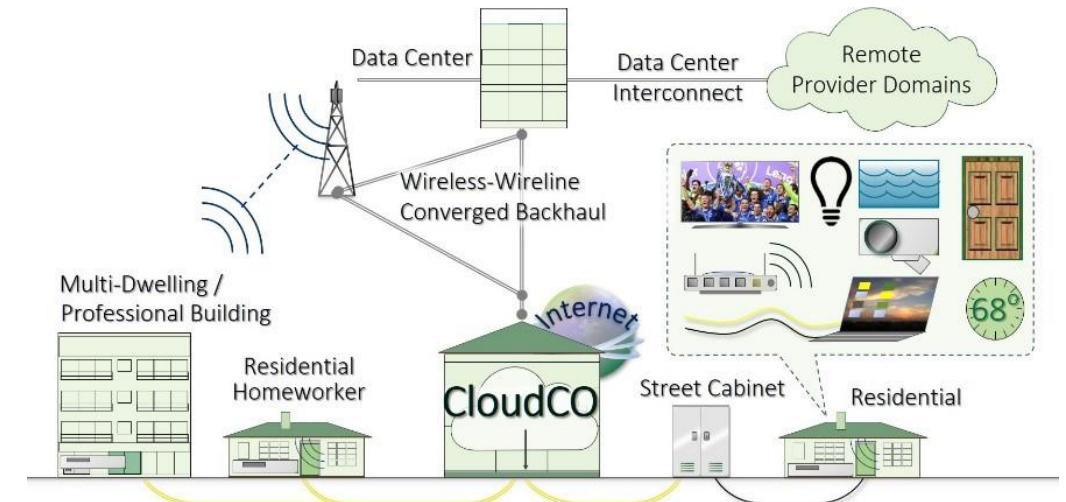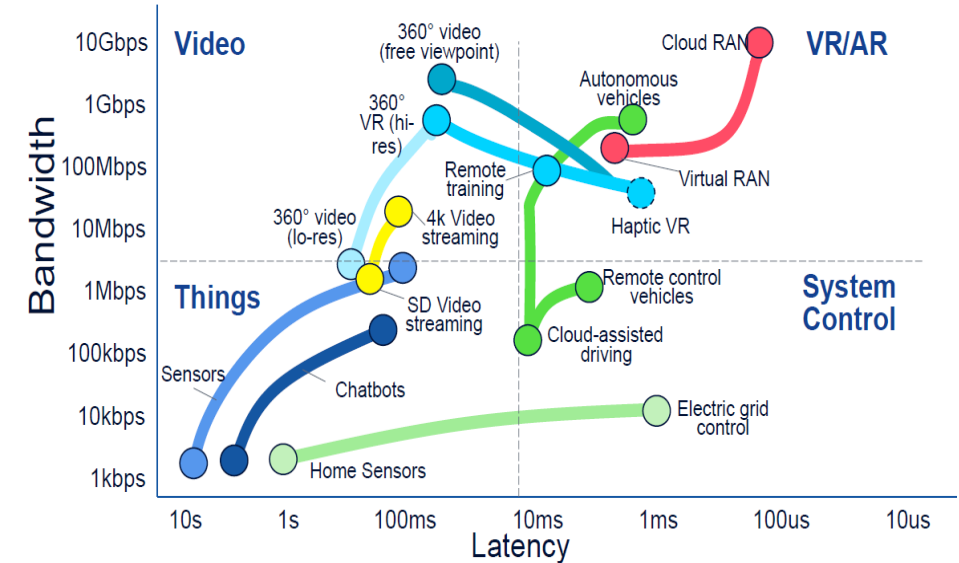## Example of use cases

- **Application use-cases:**

  - MEC can help in **improving the performance (e.g., QoS/QoE) of current and future digital services**. In fact, the use of IT resources allocated at the edge for executing service component and/or storing data/contents will reduce the network latencies.

  - This is a **powerful enabler for service scenarios where the latency requirements are particularly strict**, for example in Automotive (e.g., autonomous driving, V2X, etc); Augmented/Virtual Reality; Industry 4.0 (e.g., Cloud-Edge Robotics); Tactile Internet.

- **Infrastructural use-cases:**

  - MEC can play **a strategic role in the context of the Cloudification of 5G network functions** as enabled by NFV: specifically the Cloud Computing will be complemented by MEC.

  - It is likely that small-medium Data Centres at the edge (MEC) can host smaller Central Offices (e.g., Cloud CO initiative of Broadband Forum): this results in **CAPEX, OPEX optimizations**.
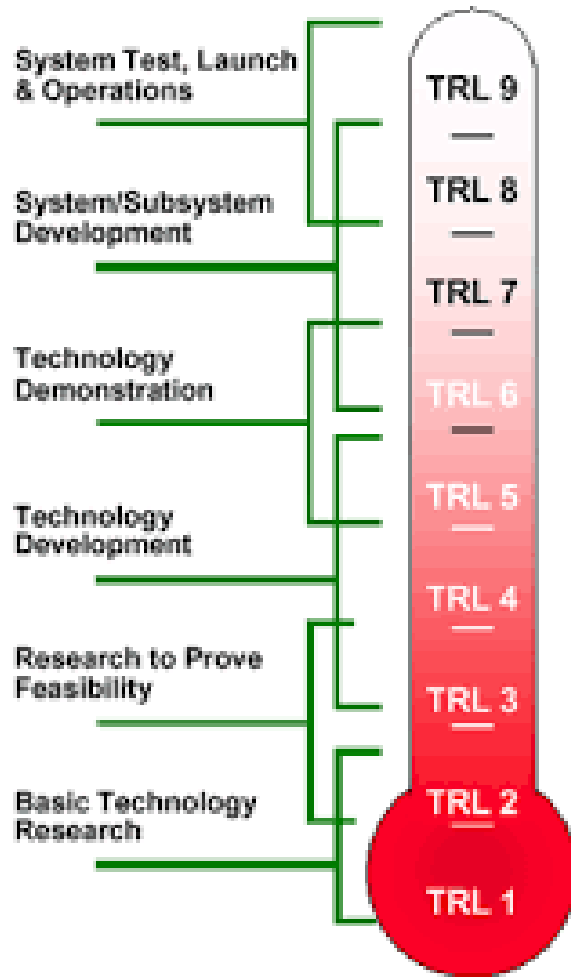
Source: https://www.broadband-forum.org/standards-and-software/major-projects/cloud-central-office

Edge Evolution (3/3)
The Technology Readiness Level of MEC

- **Technology Providers and Start-ups are already offering some MEC platforms and some other open source MEC solutions are emerging as well**

- **Network Operators are actively engaged on MEC** through Standardization Bodies, PoCs, open source initiatives: **several test-beds and field-trials are implementing and testing MEC features and capabilities**.

Challenges to move up the TRL:
- **current solutions are still lacking in end-to-end interoperability. This interoperability is a "must" and it requires more joint and global efforts in standardization (e.g. in ETSI MEC).**
- Integrated management/operations Cloud-MEC (in Future Networks and 5G) will overwhelm human-made operations, so it **will be also necessary to introduce Artificial Intelligence and cognitive capabilities at various levels of OSS/BSS and Orchestration**.

Future Networks – a systemic transformation
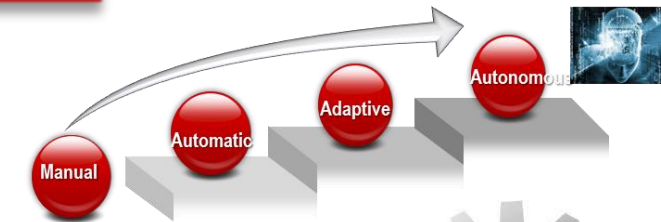
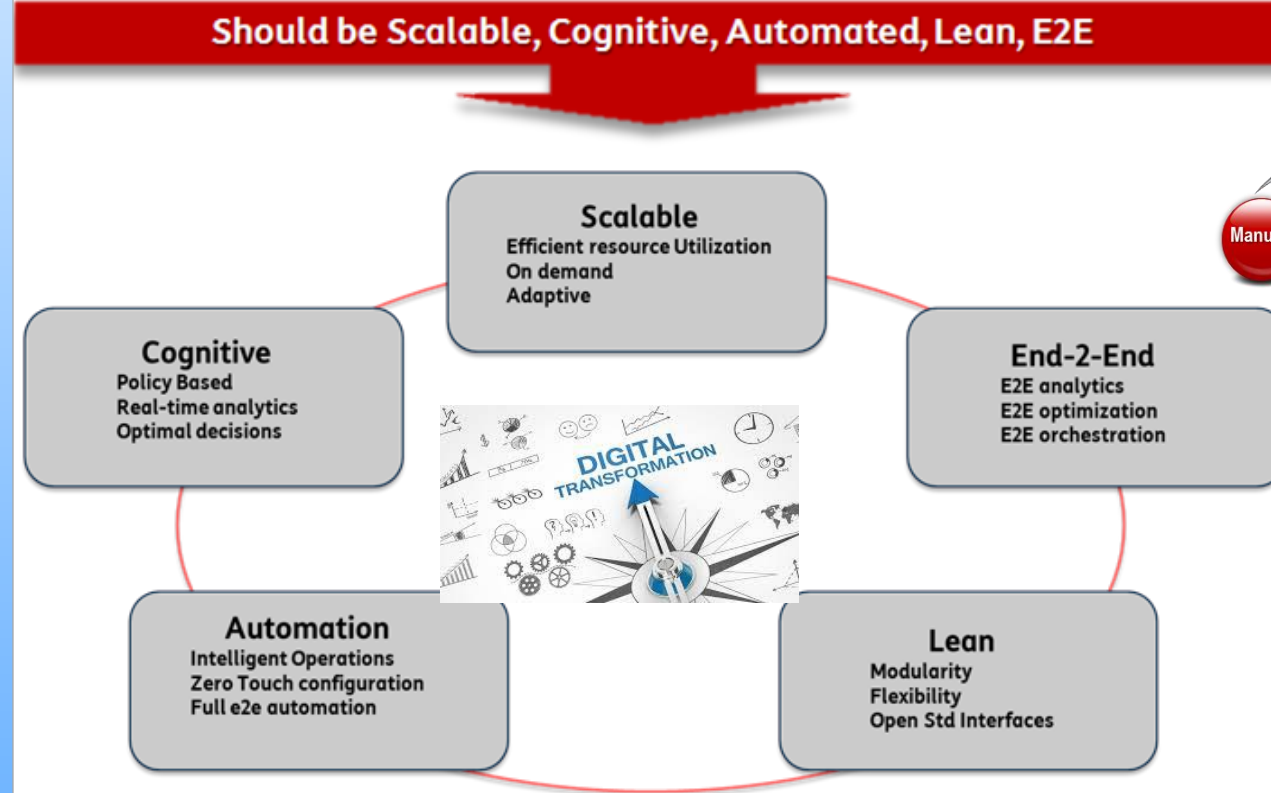**An extreme range of requirements**

  5G ecosystem ready to start

  Massive capacity, Imperceptible

  latency, Ultra-high reliability,

  Personalized services,..

Networks are transforming into

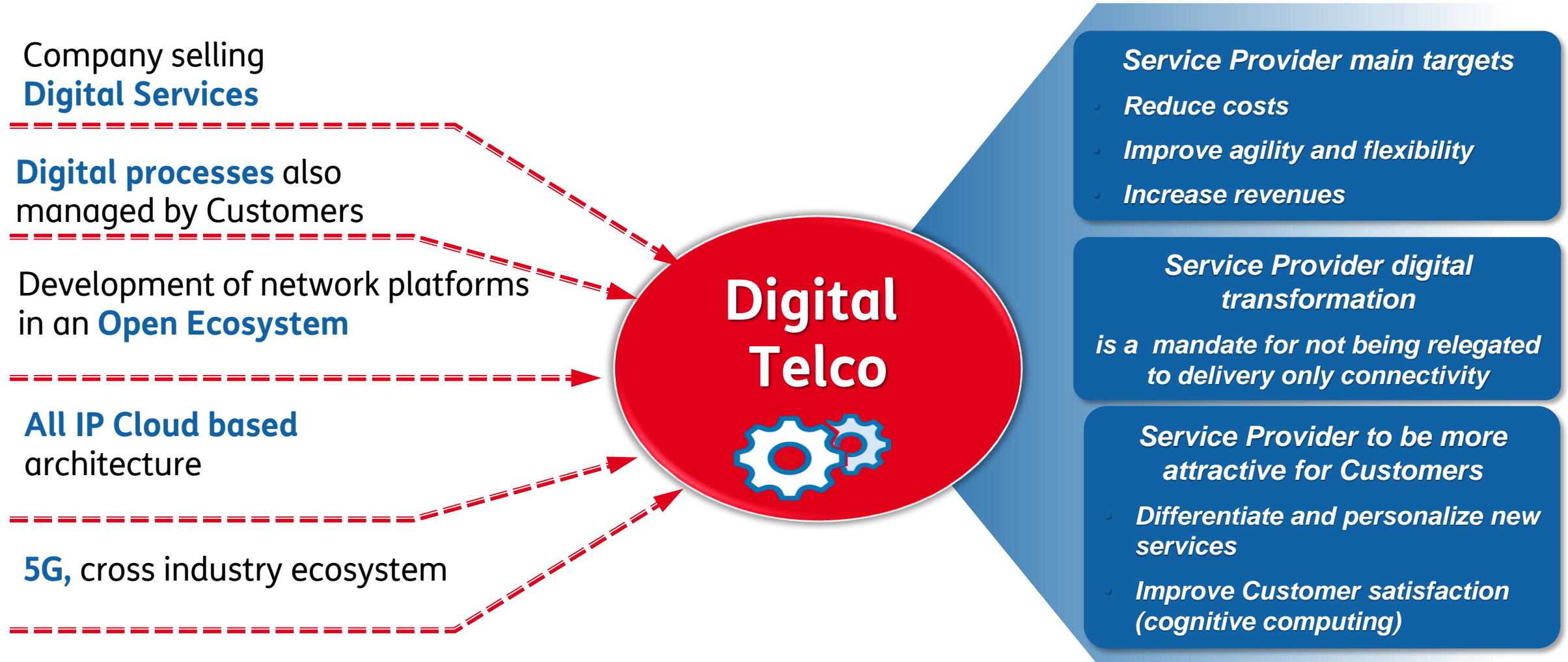**programmable, software-driven,**

service-based infrastructures

  NFV, SDN, Edge Computing…

  Growing availability of OS

  software

New architectures requiring

radical changes. New business

models

  Most enabled by technology

  breakthroughs

Intelligent Customer Management

Should be Scalable, Cognitive, Automated, Lean, E2E

Scalable
Efficient resource Utilization
On demand
Adaptive

Cognitive
Policy Based
Real-time analytics
Optimal decisions

End-2-End
E2E analytics
E2E optimization
E2E orchestration

DIGITAL TRANSFORMATION

Automation
Intelligent Operations
Zero Touch configuration
Full e2e automation

Lean
Modularity
Flexibility
Open Std Interfaces

Manual
Automatic
Adaptive
Autonomous

LEAN

Automation

Digital Service Providers journey (1/2)

Company selling **Digital Services**

Digital processes also managed by Customers

Development of network platforms in an **Open Ecosystem**

All IP Cloud based architecture

5G, cross industry ecosystem

Digital Telco

Service Provider main targets
- **Reduce costs**
- **Improve agility and flexibility**
- **Increase revenues**

Service Provider digital transformation is a mandate for not being relegated to delivery only connectivity

Service Provider to be more attractive for Customers
- **Differentiate and personalize new services**
- **Improve Customer satisfaction (cognitive computing)**

Digital Service Providers journey (2/2)

Telco Cloud to manage, control and orchestrate dynamically network and service functions

A complete redesign of Service Provider Delivery platform and processes

It is a whole business transformation not just a technology deployment but organizational too

Network Programmability & Flexibility

- NFV, SDN and cloud-scale architectures (Cloud native technology)
- Virtualization & Softwarization as the base for 5G deployment and Network Slicing
- OSS Evolution (OSS-as-a-Service, Micro-services, Automation)

Open Network

- Open Interfaces
- APIsation for two-sided Platforms and B2B2C biz models offering capabilities to partners
- Service Based Architecture (modularized services and lightweight protocols)

Management, Orchestration & Automation

- E2E Automated management of new network & services capabilities
- Network Automation in provisioning, administration & maintenance
- AI/ML in Network/Service Management as a key aspect in optimizing and automating Telco networks

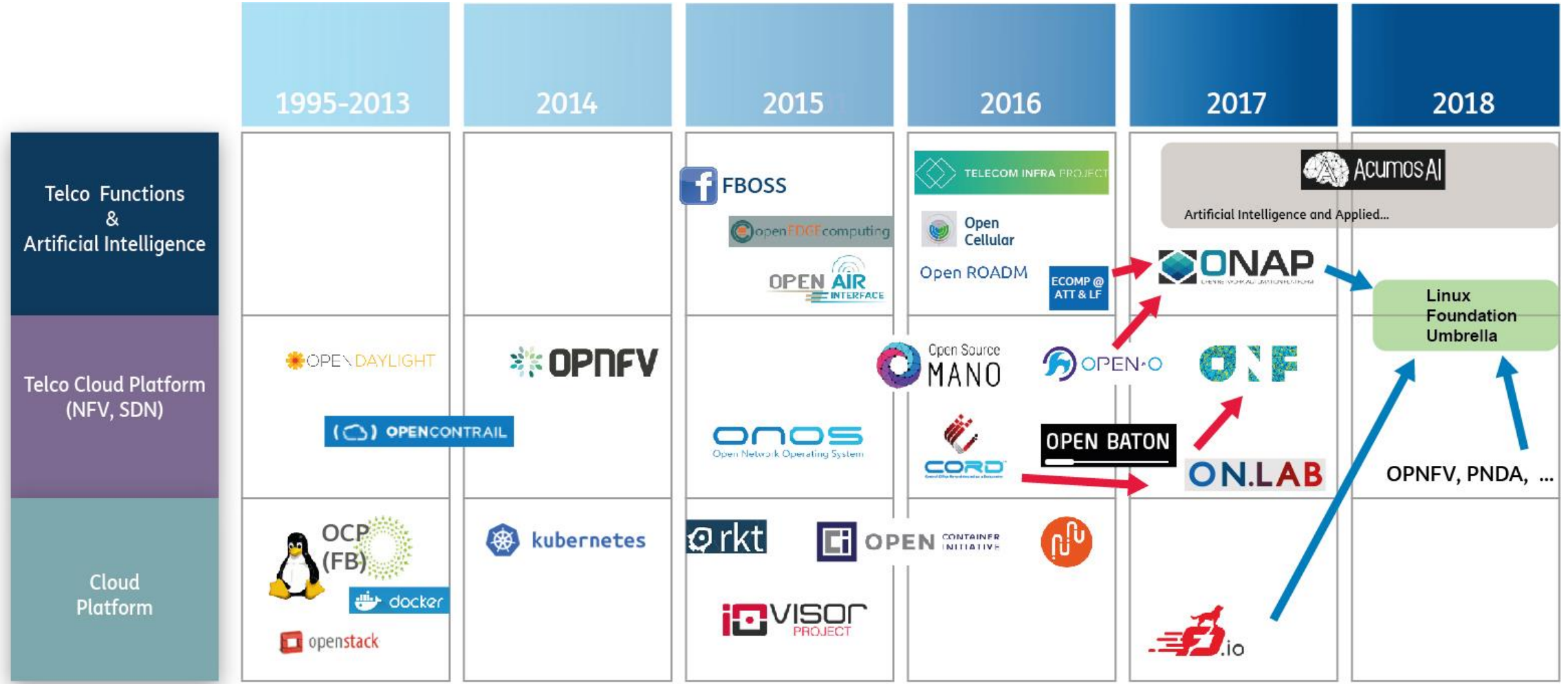*New way of thinking*

End-to-end transformation

Focus on quality & efficiency

Agile and efficient organization, data driven culture

Cooperative R&D in Standards and Open Communities

The Open Communities wave – an evolutionary scenario (1/2)
Different architectural layers and ecosystems

The Open Communities wave – an evolutionary scenario (2/2)

Telco Open communities are becoming a component of SPs Transformation Strategy

An add-on to SPs standard activity

Network softwarization, SDN/NFV paradigms, Service based Architectures, become a driver for Telco Industry to adopt OS software for carrier grade deployments

Service Providers see main benefits as:

- **Unify multiple SPs around a common approach and needs**
- **Reduce vendor lock-in and no dependence on single vendor**
- **Competition drives the market dynamics in a different way**
- **Access a talent pool and innovation skills**

Telco Open Communities offering software blocks, Reference Implementation and Networked Open Labs

Open Source enables new business models and new value chain

Open Source is the new R&D model working in a collaborative way

New stakeholders coming up

Open Source adoption requires new expertise, continued contributions, new procedures and cultural shift

SPs as Consumer, Developer or Promoter

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Telco Open Communities experience (1/4)

Our Approach to Open Source Strategy

- Participating to collaborative innovation and research open environment
- Creating new opportunities
- Consumer and /or Promoter Role
- Contributing with Use Cases
- Exploiting open platform as PoCs for trials, enabling interoperability and new services evolution
- Working on Open Platform and Community Lab as a way to validate Standards specifications
- Pursuing collaboration in the different international organization (SDOs, Fora, Open Communities) to build together the optimum ecosystem
- Enabling new way of procurement models with vendors
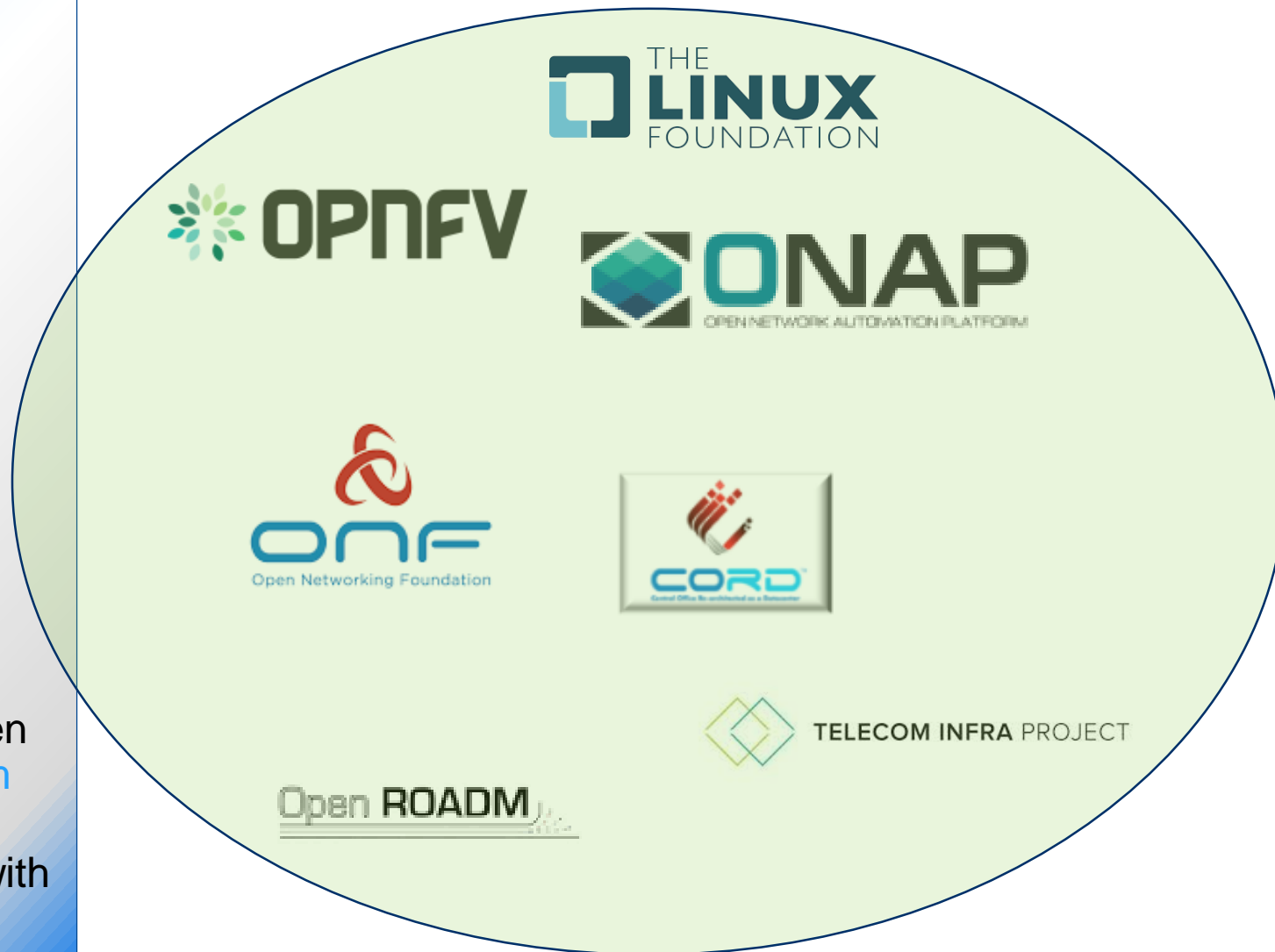
Telco Open Communities experience (2/4)

OPNFV and ONAP: two key Open Source projects focused in the area of telco software-centric network transformation where SDN/NFV automation and orchestration, NFVI, VNF onboarding and interoperability are our main targets.

OPNFV

- With its strong focus on system-level integration, development, CI/CD and testing, OPNFV provides an integration point for several open source NFV technologies
- We have gained both experiential and technical value from the OPNFV project as it allows us to leverage integration and testing of different components to be focused on evolutionary scenarios of our NFVI/VIM infrastructure
- Main affected areas as NFVI setup and scalability, geographical redundancy, automation of measures and controls
- We tested in our Labs OPNFV Releases (A,B,C) relying on internally developed testing VNFs
- Interest in Verification Program (OVP) that demonstrates readiness and availability of NFV commercial products
- Key results: a) using open source and gaining access to an open reference architecture, b) testing VNF onboarding, c) testing NFVI interoperability and VIM integration

ONAP (OPEN NETWORK AUTOMATION PLATFORM)

- Relevant platform architecture for network virtualization transformation program and OSS transformation and automation
- Internal test on Release A to understand ONAP functionalities
- We identified a first use case for ONAP Release A as integration of CORD architecture in our Lab
- Release B installed on our Lab
- Interest on Release C use case as OSAM, 5G network slicing automation and orchestration
- ONAP is a complex platform and documentation should be improved (from user perspective)
- Looking forward to a complete solution
- Pursuing Standard alignment/integration on interfaces and models would be beneficial

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Telco Open Communities experience (3/4)

FutureNet vision builds on the CORD technical approach to the design of Central Offices and PoPs
- All COs become Data Centers: from access/aggregation to metro/edge PoPs
- Disaggregation and white box approaches and technologies: no dedicated hardware in central office, neither for transport nor for access.
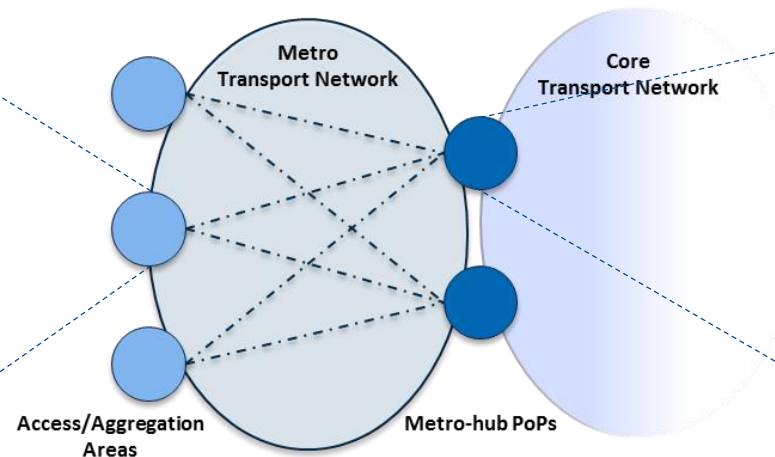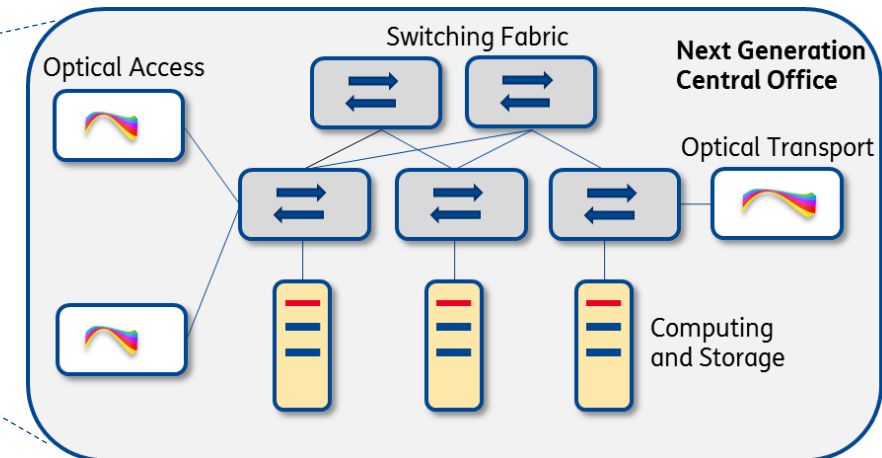
TIM FutureNet network demonstrator


Access/Aggregation POP
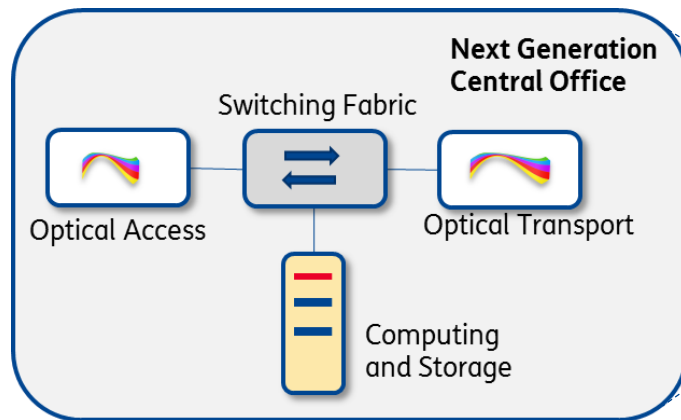
Edge POP

The geographical transport network becomes a data center interconnection network

Telco Open Communities experience (4/4)

ONAP/CORD integration in TIM FutureNet network demonstrator

- Objective: demonstrate E2E service orchestration across two FutureNet COs and a photonic transport network
- Reference Service: Point-to-point Carrier Ethernet Service (based on E-CORD use case)
- Involved vendors: Amdocs for ONAP integration
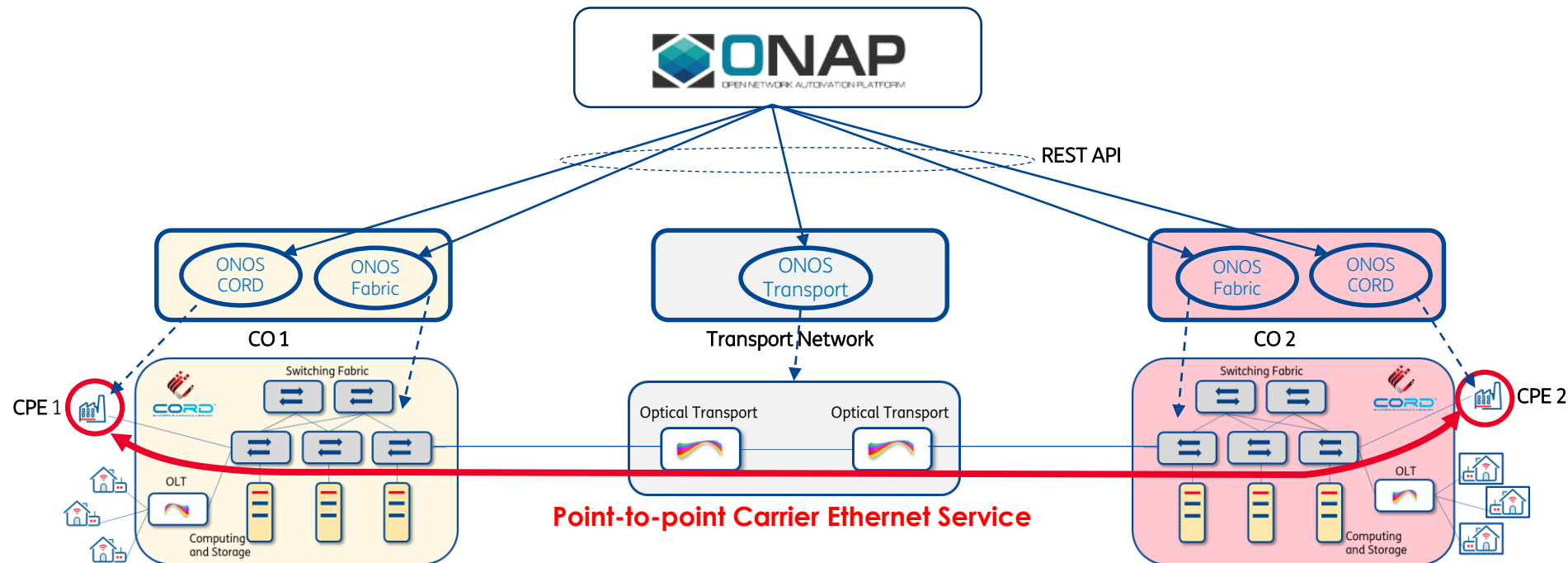
Key take aways

● Service Providers need for persistent interoperability in large scale multi-domain, multi-vendor deployment

● Network disaggregation and programmability, Automation, Orchestration and Management capabilities are extremely relevant for enabling Service Providers Digital Transformation path

● Open source is a critical driver for the change and the digital transformation underway offering the collaborative innovation of a diverse community.

● Telco Open Communities (as complement to standards) enable open ecosystem, innovation, community lab, acceleration and collaborative research for Service Providers purposes

● Service Providers Use Cases are a concrete benchmark for testing and evaluating Open Source Solutions in Lab

● Cross organisations (SDOs, Open Communities) cooperation is essential to build a robust ecosystem and to reduce fragmentation

Thank you

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